DOCUMENT RESUME

ED 196 522 PS 011 801

AUTHOR Goldsmith, Robert H.
TITLE Nutrition and Learning.
INSTITUTION Phi Delta Kappa Educational Foundation, Bloomington, Ind.
SPONS AGENCY Phi Delta Kappa, New York, N.Y.
REPORT NO ISBN-0-87367-147-3
PUB DATE 80
NOTE 34p.
AVAILABLE FROM Phi Delta Kappa, Eighth and Union, Box 789, Bloomington, IN 47402 ($0.75 each; discount on quantity orders).

EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Cognitive Development; Drug Abuse; Educational Environment; *Influences; Intellectual Development; *Learning Problems; Motivation; *Nutrition; Physical Development; Physical Health; School Policy; *School Role; Vision
IDENTIFIERS Kwashiorkor; Marasmus; Minerals; School Breakfast Program; *School Lunch Program; Vitamins

ABSTRACT

Nutritional deficiencies and imbalances can influence learning directly or indirectly. Fatigue, boredom and low motivation may be the result of poor nutrition. Some vision problems, it is known, are related to deficiencies in vitamin A. A number of studies indicate that protein-caloric malnutrition affects intellectual and psychomotor development. Few educators may realize, though, that thiamine deficiency may decrease abilities involved in learning to read and write. The effects of some nutrient deficiencies, such as thiamine, iron, and minor vitamin A deficiencies, can be easily, rapidly and completely reversed. Unhappily, the effects of protein-caloric malnutrition and major vitamin A deficiencies are not as easily changed. To some extent, however, they too can be reversed. A few studies suggest that improved environments, especially at the preschool level, can ameliorate severe effects of early malnutrition. Additional nutritional problems are associated with allergies, alchohol use, phenylketonuria (PKU), lactose intolerance, and minerals such as lead. The remarks above highlight only a few nutrition issues. Because malnutrition is possible in affluent, developed countries, educators need to develop school-wide policy and practices that extend beyond school lunch, breakfast and nutrition education programs. The effects of soft drink and candy vending machines as well as fund-raising candy sales should also be considered. (Author/RH)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED196522

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY

Nutrition and Learning

By Robert H. Goldsmith

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY

Terri Hampton

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

PS 011801

Library of Congress Catalog Card Number: 80-82680
ISBN 0-87367-147-3
Copyright © 1980 by the Phi Delta Kappa Educational Foundation
Bloomington, Indiana

NOV 3 1980

This fastback is sponsored by the New York University Chapter of Phi Delta Kappa, which made a generous financial contribution toward publication costs.

TABLE OF CONTENTS

Introduction 7

What Is Nutrition? 8

Nutrition and Learning 11
- Fatigue, Boredom, and Motivation 11
- Vision Problems 14
- Intellectual and Psychomotor Development and Malnutrition 15
- Skill Development and Thiamine Deficiency 18
- Duration of Nutritional Deficiencies 19
- Behavioral Problems: Hyperactivity 20

Special Nutritional Problems 23
- Allergies 23
- Alcohol 24
- Phenylketonuria (PKU) 25
- Lactose Intolerance 25
- Lead Poisoning 26

Nutrition and the Schools 27
- School Lunch Program 27
- School Breakfast Program 28
- Nutrition Education 29
- School Nutritional Environment 30

Summary 32

Bibliography 33

ROBERT H. GOLDSMITH

Robert H. Goldsmith is a professor at St. Mary's College of Maryland, where he has been teaching chemistry and nutrition and supervising science student teachers since 1967.

He received his bachelor's degree in chemistry from Loyola College, his master's degree in education from Johns Hopkins University, and his doctorate in chemical pharmacology from the University of Maryland. During a recent sabbatical he undertook a program of study and research in nutrition at the University of Maryland.

His research interests are in the areas of micronutrients and molecular modification. His work in science education has focused on increasing public understanding of the role of science in contemporary society.

His publications include articles in *Journal of Chemical Education*, *School Science and Mathematics*, *American Journal of Physiology*, *Science Teacher*, and *Environmental Contamination and Toxicology Bulletin*. He serves on the General Chemistry Subcommittee of the American Chemical Society's Examination Committee. He and his wife were selected as Danforth Associates in 1978. He is a member of the National Science Teachers Association and Phi Delta Kappa.

Introduction

Is nutrition related to learning? If so, how? Obviously in cases of severe nutritional deficiency a person will not function properly, may become ill, and may die from malnutrition. But what about the more subtle relationships between nutrients and learning that may not always be obvious to the observer? Educators need to be aware of all the environmental factors that affect learning. Nutrition is one of those factors.

In this fastback we shall examine the nature of nutrition, discuss certain learning problems that may be nutritionally related, and consider certain special nutritional problems with which teachers may need to deal. We shall also explore the role educators may play in nutrition education and in creating a positive nutrition environment in the schools.

What Is Nutrition?

Notions about the relationship of various foods to our physical and mental health have existed for centuries but only recently has nutrition been studied scientifically. The last century identified the nutritional components of carbohydrates, fats, and proteins. This century has brought us knowledge of the variety of vitamins and minerals that are so essential for our existence and good health. Even today, the list of minerals contributing to our well-being continues to grow as our research expands.

Nutritional science is an interdisciplinary field of study. It uses knowledge from the fields of biology, chemistry, psychology, epidemiology, economics, and many others. Nutrition, essentially, is the science that studies the interrelationships between man and his nourishment.

The human organism must continually carry out a large number of complex chemical reactions to survive. These chemical reactions supply needed energy, manufacture needed chemicals, promote cell growth, repair damaged cells, and maintain those physical and mental processes that keep us functioning. Nutrients is the term applied to those chemicals that are involved in the vital nourishing process. Nutrients must be ingested in sufficient quantities to replace consumed chemicals and to provide the substances that keep the basic chemical reactions functioning.

Nutrients fall into six categories: carbohydrates, fats, proteins, minerals, vitamins, and water. Carbohydrates include the sugars and starches, which are the main sources of energy, and cellulose, the complex carbohydrates that serve as fiber sources. Fats provide essential fatty acids, help in the absorption of certain vitamins, and also pro-

vide energy. Proteins are tissue builders and also form the substances known as enzymes that carry out the body's chemical reactions and maintain the body's important immune system. Vitamins form compounds that work with enzymes to carry out vital chemical body reactions and act in other significant roles. Minerals maintain body structure, work with enzymes to carry out specific reactions, act as buffers, control osmotic pressure, and perform many other functions.

The body needs nutrients in specific amounts. The recommended dietary allowances (RDA) formulated by the National Research Council give an estimate of the amount of nutrients needed at different ages. Of course, the chemistry of each person is different, so there is much variation in individual needs.

Public understanding of nutrition is confounded by the amount of confusing and contradictory information that is provided by the media. Nutritional misinformation is widespread. New diet fads, some based on single-food diets, appear with predictable regularity. Beliefs about food and nutrition among some diet faddists take on an intensity that verges on fanaticism.

Some consumer advocates charge that not enough nutritional information is being provided so that people can make intelligent nutritional decisions. With the inflation of food prices many persons cannot exercise their freedom of choice because of their inability to buy what they need, a condition that has affected the poverty-stricken for some time. Another problem is the increasing availability of prepared foods of questionable nutritional value. The convenient accessibility of such foods often results in their replacing food of a much higher nutritive value. Teenagers are particularly vulnerable to nutritional deficiency because of their preference for highly processed foods available in their favorite fast-food restaurant. Even students knowledgeable about nutrition may have a hard time knowing whether a certain highly processed food is nutritionally valuable or worthless. A classic example is the artificial pizza where the cheese is not cheese, the pepperoni is not pepperoni, and the tomato sauce is not made from real tomatoes. While such a food product may look like a pizza, nutritionally it has little resemblance to a real pizza. Does the teenager know whether this is a good choice or a poor choice?

In spite of our food-bountiful society, malnutrition is quite possible. One tends to think of malnutrition as a condition resulting from a lack of given nutrients. But an excess of given nutrients might also lead to problems. One needs a minimal amount of vitamin A to maintain good vision, but too much of that vitamin is toxic. A diet that is too high in calcium can prevent the absorption of a number of other essential minerals, including iron and magnesium. Of course, malnutrition can result from other causes, such as a stomach disorder, which interferes with or prevents normal absorption.

The nutritionally informed person should also be aware of the many chemicals in foods that may have an effect on the body in ways other than nutritionally. Stimulants like caffeine are found in many common beverages. The amino acid known as tryptophan found in meat and milk has been found to have a depressant effect. Eating a large steak or drinking a large glass of milk at bedtime can produce a sedative-like effect that helps me get to sleep more easily. Chemicals such as those found in nutmeg can have a pronounced psychological impact, sometimes even hallucinogenic. Besides all of these natural chemicals, there are also many chemicals in food known as additives. Compounds routinely added to foods include various preservatives, emulsifiers, anticaking compounds, and various synthetic flavoring and coloring agents.

The above highlights only a smattering of nutrition issues and information. The field of nutrition is vast and complex; many aspects of it will remain the preserve of the specialist. But all of us are affected by nutrition and need to have a basic understanding of nutrition concepts. Educators, especially, need accurate and up-to-date nutrition information, because, as we shall see in the next section, many facets of nutrition are related to learning; and educators should be the specialists when it comes to learning.

Nutrition and Learning

Teachers commonly encounter behavior in students that creates learning problems. That such problems might have nutritional implications is worthy of investigation. Let us explore specific nutrients that might be implicated in a variety of behaviors that are symptomatic of learning problems.

Fatigue, Boredom, and Motivation

One behavior frequently observed by teachers is the tired, apathetic, or bored student. Many factors could be responsible for this behavior, including poor nutrition. Each child has his or her own optimum caloric need in order to develop normally, to feel healthy, and to be mentally alert. Either too few or too many calories can be detrimental to general health. Many fad diets are inadequate in calories. The so-called macrobiotic diet #7 provides at a maximum 1,200 calories daily, which are much fewer than are required to sustain the activity pattern of the average adolescent. Ehret's nearly all-fruit diet is so low in calories that followers of it will likely develop some of the symptoms of starvation, such as headaches. Diets that are too low in calories tend to produce tired, lethargic adolescents. The importance of a well-balanced breakfast (the meal frequently skipped by adolescents) in supplying adequate calories will be discussed later in this fastback.

Intake of too many calories resulting in obesity is also a cause for concern. One study of 12,000 schoolchildren found that 30% of this group was overweight. Other studies have shown that from 9% to 13% of adolescents are overweight. The psychological effects of girls being overweight have been studied by Jean Mayer, the distinguished nu

tritionist. He has noted that they may exhibit such personality traits as insecurity, withdrawal tendencies, and a passive disposition. Upon experiencing failure, whether in school or home, they may blame their problems on their weight rather than trying to find the real solution. Too many calories, too little exercise, genetic disposition, and other unknown factors are responsible for obesity problems. Some of these factors are beyond the influence of the schools, but good results have been reported in the literature of schools that have established weight control programs for obese students.

Other nutrient deficiencies also affect behaviors that lead to learning problems. Iron-deficiency anemias cause a debilitating condition that can influence a student's performance. Studies suggest that anemia in the preschool years has a negative impact on motivation and on the capability to concentrate over a long period of time. One recent study has shown the average iron intake of girls aged 12 to 19 to be 30% or more below the RDA. Boys aged 12 to 14 have a 21% to 29% iron deficiency, while those from 15 to 17 have a 1% to 10% deficiency. Many believe iron deficiency is the most common nutritional deficiency among American youth.

Iron is a necessary part of the hemoglobin molecule that carries oxygen throughout the human system. A student with anemia may be pale, short of breath, and will tire after only slight effort. Headache and/or dizziness are also symptoms of anemia. The anemic youngster will seem tired, listless, and not interested in learning. Anemic students may be unjustly criticized by the teacher who is not aware of this condition as being uninterested in learning, not putting out any effort, not performing up to expectation. Anemia may be caused not only by iron deficiency but also by a copper deficiency and possibly even by a deficiency of the mineral molybdenum.

A deficiency of vitamin B-12 has been connected to a different kind of anemia, resulting in extreme depression and mental confusion in one patient. Studies in other countries have shown that a zinc deficiency can result in decreased alertness and increased fatigue.

There are a number of physicians who believe that hypoglycemia or low blood sugar is a growing nutritional problem. Whether or not it is a serious problem is yet to be determined, but certain experts in this

[illegible]d have estimated that 10% to 15% of the normal population suffers from low blood sugar. These experts believe that many hyperactive children suffer from this disorder also. One doctor who has studied hypoglycemia in various patients has listed the following percentage of his patients reporting these particular symptoms: irritability (89%), exhaustion (87%), fainting (86%), depression (77%), drowsiness (72%), forgetfulness (67%), constant worrying (62%), mental confusion (57%), indecisiveness (50%), and lack of concentration (42%)—all symptoms that could affect learning.

One of the ironies of hypoglycemia or low blood sugar is that the condition seems to be worsened, not improved, by consuming more sugar. Additional sugar has the effect of forcing the body to lower blood sugar levels even more. It is poor advice to recommend to a hypoglycemic child that he or she take a candy bar or some other source of readily available sugar. The proper diet for such a student is to take in as little sugar as possible and to consume a low carbohydrate diet over six small meals rather than the typical three meal pattern.

Hypoglycemia may be a factor in some unusual behavior patterns. Catherine Frederick notes that hypoglycemia has been recorded in autistic children as well as in cases of mental retardation. Hippchen, at Virginia Commonwealth University, has suggested a connection between hypoglycemia and criminal behavior. He believes that students who exhibited hypoglycemia symptomology tended to be poor learners and disruptive; as they got further out of touch with the learning environment they eventually showed antisocial behavior. It should be pointed out that this connection of low blood sugar with various behavior problems does not imply that hypoglycemia is the cause of the problem. However, it behooves us to be alert to symptoms that might be associated with hypoglycemia.

Thiamine deficiency is another nutritional factor that may be implicated in cases of excessive fatigue and irritability. One early study of six students who received only 0.2 milligrams of thiamine daily found that at the end of two weeks these students felt and looked quite dispirited. Williams found evidence of fatigue and irritability at levels of .95 milligrams of thiamine. Similar symptoms of fatigue and lassitude were found by Jolliffe using levels of 0.5 milligrams of thiamine.

These amounts are clearly less than the RDA and less than the average daily amounts of 1 to 1.5 milligrams consumed in the U.S. today. It is currently estimated that the extent to which thiamine intake is below the RDA is 1% to 10% in males and females aged 12 to 14; 11% to 20% in females aged 15 to 17; and 1% to 10% in females aged 18 to 19.

Of course, every student who is tired, unmotivated, unable to concentrate, or irritable is not necessarily suffering from a nutritional imbalance. There may be many other factors contributing to this behavior, including peer influences, home environment, excessive activity, or lack of sleep. Yet nutritional influences should be considered when making a diagnosis of any particular student's behavior problems.

Vision Problems

Good vision is essential if students are to undertake the large amounts of reading needed to succeed in school. The key nutrient affecting vision is vitamin A. Good sources of vitamin A are liver, egg yolk, and butterfat. Precursors of this vitamin are also found in our green and yellow vegetables. These precursors, known as the carotenes, are converted into vitamin A within the body.

It is a matter of serious concern that available levels of vitamin A have been going down for the last 30 years. A survey of U.S. vitamin A intake conducted in the early Seventies indicated that people's average intake was frequently lower than the RDA. Other studies have indicated that girls aged 12 to 14, 18 and 19 have an average intake that is from 1% to 10% below the RDA. While this statistic may not in itself be cause for alarm, it is important to note that some students will have much higher deficiencies than the average suggests. One survey of 70,000 low-income people that was conducted by the Nutrition Service Program of the Public Health Service found that about 13% had less than adequate levels of vitamin A.

A severe deficiency of vitamin A could lead to total blindness, but the earliest signs of this deficiency are of special concern to educators. One early manifestation of vitamin A deficiency is night blindness. This condition might not be apparent in our brightly lighted classrooms, but it could be a problem for students who study at night in

poorly lighted rooms. Finding it difficult to read much at home, they may not complete their assignments.

Severe cases of vitamin A deficiency can lead to damage of the epithelial cells in the eye leaving them susceptible to infection, or the cells may even burst open. A mild change in corneal tissue of this kind is known as Bitot's spots; a more severe form is known as xeropthalmia. These severe cases would be relatively rare in the U.S. today, but in many parts of the world vitamin A deficiency is widespread, and it is estimated that about 80,000 children each year become blind from this deficiency.

Vitamin A deficiency should be one variable to consider in the case workup of a poor reader where no other clear causal factor is present. Such a deficiency is not easily diagnosed, but it could be included as part of an ophthalmological workup.

Intellectual and Psychomotor Development and Malnutrition

There have been a number of studies that have investigated the relationships between malnutrition and mental ability. These studies have been characterized by great variations in methodology, making it difficult to separate nutritional factors from other environmental factors that might influence intellectual development. Furthermore, the measurement of IQ in these studies has not been without methodological difficulties.

Several tests have been used more frequently than others. The Gesell test has been used to secure a developmental profile for children from four weeks up to 60 months of age. This test is based on direct observation of the child and parental interviews; it assesses the areas of motor capacity, language behavior, adaptive skills, and social emotional situations. The Merrill-Palmer Scale for children aged 18 months to six years assesses IQ by using tests of language problems, motor abilities, conceptualization, and others. The Binet tests and the various Wechsler tests are generally familiar to most educators. Others, such as the Draw-a-Man test, are also given.

Of concern to us are those studies involving protein-caloric malnutrition. Marasmus is the term used for both caloric and protein deficiencies; kwashiorkor is the term used for severe protein deficiency

only. Protein is quite important in the development of the nervous system. Brain enzymes composed of protein keep our mental functions in proper balance.

Nutrition studies with animals have been instructive. For example, the rat has been the subject of numerous nutritional deprivation experiments and provides much useful information. Researchers have shown that the young deprived rat does not turn out to be a particularly smart rat. It can't solve mazes as rapidly and it is frequently smaller than rats in the control group. Its brain may have a reduced number of cells. However, while there is much useful information from animal studies, one cannot extrapolate from rat data to human beings with confidence. Human studies must provide us with more reliable data.

One significant study done in 1963 found that malnourished South African children exhibited lower IQs compared to controls and the lower scores persisted over a substantial follow-up period. Significant differences were noted in the areas of problem solving, vocabulary development, pattern completion, and the blocks and form board. In 1965 a study of children in Yugoslavia showed that marasmus during the child's first year was associated with a lower IQ relative to the general population; the IQ in a subsequent follow-up study was positively correlated with the severity of the original nutritional deficiency. This correlation between severe malnutrition in infants and subsequent poor performance later in life was also demonstrated in a 1970 U.S. study of infants conducted over a three-and-a-half year period that found especially low scores in adaptive behavior and gross and fine motor skills.

One Indian study attempted to determine whether children who had kwashiorkor early in life but were treated in a hospital at about 27 months would perform as well as a control group. A number of areas were compared. The kwashiorkor children's perception as measured by the child's ability to complete pictures, assemble a single object, and work with block designs was significantly lower than the perceptive abilities of the children in the control group. Their abstracting ability as measured by various arithmetic tests and reading comprehension tests was also lower. These children did not do well in intersensory organization-type tests. They did better in memory tests and verbal situa-

tions than in the three tests previously mentioned, but their test results here were still lower than the control group's. These differences were still present six or more years after the students had been certified as restored to normal health.

Craviato and his co-workers have conducted a number of studies concerned with specific learning mechanisms. Children severely malnourished in their first 30 months had lower scores than their controls in a test designed to determine the ability to bring together information received visually and orally. This deficit in the development of the integrative aspects of the nervous system has been identified as a factor that may contribute to reading problems.

Craviato in another study found that children, even after recovering from early malnutrition, achieved lower in tests that require the integration of visual and kinesthetic information, e.g., moving an arm or hand in response to a visual stimulus.

Some of the research reported above shows how malnutrition is associated with deficiencies in making major discriminations in perception and motor development. Other researchers have studied the relationship of malnutrition to fine discrimination. For example, the ability to detect the subtle differences between the letters b and d is a fine discrimination important in reading. A test was designed using geometric figures arranged in various planes. The test results showed that previously malnourished 5- to 9-year-olds did not do as well as the control group in recognizing the geometric forms in various planes. However, the mean number of errors of the malnourished group became less as the children became older.

A British study showed significant differences between malnourished and control groups in the Goodenough Draw-a-Man test. A U.S. study found that younger malnourished children, compared to controls, had lower scores on the Merrill-Palmer tests and scored significantly lower in various fine motor function tests. However, children over 11 by the end of the study showed no significant differences in several IQ tests between the previously malnourished group and the control group. In studies involving middle-class populations particularly, the major difference between malnourished and control groups is in fine motor functions; in lower socioeconomic groups, lan-

guage development and adaptive behavior are the two attributes where major differences occur. Difficulties with the concept of time have also been demonstrated among malnourished groups.

Not all studies of malnourished groups reveal significant differences with controls, and several studies, especially those dealing with older children, have not found any significant differences between the two groups. Nevertheless, there is enough data to suggest that various aspects of learning behavior can be influenced, at least temporarily and in some cases permanently, by protein-caloric malnutrition.

Skill Development and Thiamine Deficiency

As noted in the previous section, specific skills such as reading and writing can be adversely affected by caloric-protein deficiencies. Thiamine may also have a role in this area.

One early and controversial study of the role of thiamine in learning used a population of 117 children, aged 4 to 20, at an orphan home in Virginia. The children took a series of tests covering 18 tasks. Of the 18 tasks, 14 were paper-and-pencil tasks involving addition, subtraction, multiplication, division, mixed fundamentals in arithmetic, problem solving, encircling two adjacent numbers whose sum is 10, proofreading (underlining 4s on a page of different numbers and underlining Bs on a page of different capital letters), number span, completion of design, code learning, and reading speed plus accuracy. Two tasks were games requiring skill and accuracy in aiming. The final two tasks involved tests of grip strength as measured by a dynometer on both hands. The period of the tests was six weeks.

The children were divided into two groups as evenly matched as possible with regard to age, physical size, sex, weight, and school experience. After the children had all been assigned to one of the two groups, the investigators secretly determined which group was to serve as the control and which was to be the experimental group and receive the thiamine supplement.

Each person in both groups was given an envelope each day bearing his or her name and containing a pill. The pills looked identical, except that those in the experimental group were getting 2 milligrams of thiamine per pill while those in the control group were getting a

placebo. The diet at the orphanage was found to have on the average 0.9 milligrams of thiamine per day for each child, an amount considered inadequate using current RDA standards. During the six-week period of the experiment, the 18 tasks were practiced regularly and the results were recorded nine times.

The results of the experiment showed consistent gains by the thiamine group over the control group. The thiamine group's gains over the control group among the measured activities varied from 7% to 87%. On the average, the experimental group improved over the control group by approximately 27%.

This experiment is frequently mentioned by those who advocate thiamine supplements to the general diet, but it should be noted that this study has been criticized on several grounds. Certainly, one should not conclude that thiamine addition to the diet will improve everyone's skills. Nevertheless, thiamine deficiency, which is a recognized factor related to fatigue, may well be a factor related to other aspects of learning also. Thiamine is a key nutrient that should be closely watched.

Duration of Nutritional Deficiencies

Does early malnutrition result in permanent impairment or can it be reversed? The question of the duration of the effects of nutritional deficiencies is an important one for educators, because if they can be reversed, the schools can play an intervention role. The effects of some nutrient deficiencies such as thiamine, iron, and minor vitamin A deficiencies can be reversed by the addition of the missing nutrient to the diet. Most often, as with a thiamine deficiency, these adverse effects are reversed quite rapidly and completely. However, the effects of protein-caloric malnutrition are not as easily reversed.

The most serious effects of malnutrition occur during infancy. Studies have shown that these effects may continue up through the teenage years. Yet in assessing how long the effects continue, it should be noted that malnutrition is usually only one factor in an overall poor environment. Can the improvement of other factors through environmental enrichment correct the long-term effects of early malnutrition? Several studies supply us with some hope.

In one study 150 Korean orphan girls were divided into three groups: severely malnourished, marginally malnourished, and well-nourished. The girls were placed for adoption into families with an adequate home environment. This placement occurred prior to their first birthday. Their progress was followed by sending questionnaires to the family and by obtaining the children's school records with IQ scores and other achievement tests results. Test data on the children were collected periodically from ages 7 to 16.

Regarding IQ, the marginally malnourished children had scores not significantly different from the severely malnourished children, but these two groups tested significantly lower than the previously well-nourished group. However, the scores of these two groups were comparable to those obtained for average well-nourished American children. Regarding achievement, the previously well-nourished group was achieving at a slightly higher level than the other two groups, whose differences were statistically indistinguishable; however, all three groups were performing at levels that American children of the same age and grade were achieving.

A study of Columbian children found that environmental stimulation of previously malnourished children enabled those children to perform better than malnourished children who were left in a non-stimulating environment and as well as well-nourished children from a higher socioeconomic group.

These studies provide some evidence that improvement of the environment can ameliorate severe effects of early malnutrition. By providing stimulation and enrichment, especially at the preschool levels, educational institutions help in overcoming at least some and perhaps most of the adverse effects of early malnutrition.

Behavioral Problems: Hyperactivity

One of the most challenging areas facing educators today is disruptive behavior associated with hyperactivity. We have seen how hypoglycemia can influence behavior. Benjamin Feingold, who became concerned about the large number of chemicals that have been added to our food products since World War II, has focused attention on the possible role of food additives in hyperactivity. From an early

clinical observation of the change in behavior in a female patient following a diet in which various artificial colors and flavors were removed, he theorized that hyperactivity might be related to these chemicals and developed a so-called elimination diet that was successfully employed in a number of cases.

Hyperactivity is frequently associated with learning problems. The hyperactive child cannot pay attention for any length of time and appears to be unusually active. Many children who are so diagnosed are treated by the administration of certain drugs such as Ritalin. Feingold objects to this form of treatment for several reasons and believes a diet that eliminates artificial coloring and flavoring agents as well as those foods that contain salicylates is a better remedy. Feingold believes his elimination diet is responsible for the improvement of the behavior of several hyperactive children that he treated over a long period.

Reaction to Feingold's views has varied from enthusiastic to quite hostile. Several controlled studies have tended to support Feingold's viewpoint to some degree. One study found that some students' attention span was interrupted after they consumed food containing color agents. A British study found improvements in several behavioral aspects when an elimination diet was used. Both of these studies suggest that there are some children who are sensitive to food colors.

On the other hand, a Wisconsin study indicated that the addition of food colors to a standardized diet did not produce any changes. A more recent study indicated that learning ability may be influenced only by rather large doses of food colors. This study does confirm that certain food additives can act like drugs. Two recent studies are relevant here. The first supports the drug viewpoint of food dyes as drugs. Forty children were placed into two groups, one diagnosed as hyperactive and the other as nonhyperactive. Using a blind study with a placebo and evaluating by means of paired-associate learning tests the investigators, Swanson and Kinsbourne, found that a high level of food dye mix lowered the attention span of the hyperactive children. They also noted that the patterns of onset and duration of hyperactivity were essentially drug patterns. The quantity of dye used was 10 times the amount used in previous studies. In the second study 22 children were periodically exposed to predetermined amounts of seven food dyes.

This was a double blind study in which each participant acted as his or her own control. Ten specific behaviors were selected as reaction criteria. It was found that only one child demonstrated some behavioral response to color additives, while another did so more strongly with natural salicylates.

To summarize, the evidence about the effects of food additives on behavior is neither completely clear nor decisive. Some children, perhaps a very small group, do appear sensitive to food colorings, and their behavior can be improved by eliminating the offending chemical. One does not easily identify these children and no diet should be instituted without qualified medical advice. Crash fad diets are certainly inappropriate. An elimination diet, used properly, may be one approach for hyperactive children, but other psychological contributing factors should also be considered in the diagnosis and treatment of such children.

Special Nutritional Problems

There are several special nutritional problems involving selected students that might affect their learning progress. Educators should be familiar with these special nutritional problems and be alert to symptoms among their students. Some of the more common problems are discussed below.

Allergies

Allergy is the body's reaction to the introduction of certain chemicals (antigens) which cause the formation of specific protein molecules (antibodies) that are able to attach themselves to the invading chemical agent and destroy it. It is not completely understood how or why this happens, but the normal responses of the body associated with this antigen-antibody interaction become altered. Cells damaged due to this alteration process continue to release a number of potent chemicals, such as histamine, which can cause damage to other cells as they travel.

Many different foods can be involved in allergies and they can set off a wide variety of allergic responses, such as respiratory sensitivity, gastrointestinal upset, skin reactions, and various neurological reactions. Neurological reactions include headaches, peripheral responses, irritation, and hyperactivity. Gastrointestinal reactions involving poor food absorption and vomiting are quite serious since they can lead to other nutritional problems. Clearly, the child with an allergic reaction experiences symptoms that can impair concentration and adversely affect learning.

Allergies are extremely complex. In fact, treating allergies has be-

come a medical specialty. Environmental and psychological factors as well as food chemicals may cause allergic reactions. Infants and children may be sensitive to common proteins such as those found in milk. The protein in egg white is considered another common allergin. A partial list of foods that are potentially allergenic includes many common foods popular with children, including fish, wheat, strawberries, tomatoes, citrus fruit, nuts, pork, bacon, chocolate, peanut butter, and pineapple.

Many antigens are found in foods commonly served in school lunch and breakfast programs. The very nebulous nature of allergic responses makes it difficult to connect an observed symptom with a potential allergin, but if student health records identify those with specific allergy conditions, then educators will be aware of the problem and make modifications in the school menus for selected students.

Alcohol

Alcohol is usually viewed as a drug problem. Indeed, the rising incidence of alcoholism among youth is a matter of great concern to educators. This increasing consumption of alcohol also has several serious nutritional implications, which are the concern of this fastback.

Data on the nutritional impact of alcohol have largely been obtained from studies on patients hospitalized for alcoholism. Data from this population cannot be directly applied to moderate or social drinking. Nevertheless, the nutritional problems observed in these patients as well as studies of alcohol consumption by moderate drinkers give us several areas to examine.

Alcoholism is known to have a number of nutritional effects on the liver, such as alteration of vitamin A metabolism leading to night blindness and an increased number of cases of zinc deficiency. Low magnesium levels are also frequently observed in alcoholics. One of the most significant adverse influences of alcohol is thiamine deficiency, a deficiency that has many implications for learning. Anemia has also been found in many alcoholics. Even with well-nourished subjects, alcohol consumption has been shown to decrease the absorption of thiamine as well as vitamin B-12.

While a small amount of alcohol may stimulate the appetite, a large

amount, with its large supply of calories, actually decreases the appetite. This means empty calories are replacing a well-balanced diet. Also the effects of alcohol on the intestine and the stomach may contribute to weight loss in confirmed alcoholics.

Alcohol education programs should include information about the possible nutritional consequences of excessive alcohol in addition to its drug-related aspects.

Phenylketonuria (PKU)

PKU or Phenylketonuria is a metabolic disorder in which the presence of more than a minimal quantity of the essential amino acid phenylalanine results in either severe mental retardation or mental impairment if untreated. This is a genetically related deficiency in the enzyme that controls normal metabolism of phenylalanine. However, the condition can be controlled if detected early by means of a special low phenylalanine diet. Continuing studies of this treatment reveal that students' mental functioning remains normal while they stay on the diet. There is still some controversy as to whether the students have to stay on this diet for the rest of their lives.

A student frequently will need encouragement to stay on the diet because of peer pressures. This is an important support role for the school, since this special diet eliminates such foods as hamburgers, ice cream, and milk—all popular foods with students.

Lactose Intolerance

Perhaps the major nutritional problem in the world is that of lactose intolerance. The inability to tolerate lactose from drinking milk results in a number of unpleasant physical symptoms. These include gastrointestinal distress, diarrhea, and cramps. Lactose intolerance seems to be prevalent among many races, but Caucasians do not seem to be affected.

Since many schools have subsidized milk programs, educators must be aware that children with lactose intolerance will avoid milk, or if given milk will throw it away. It makes no sense to force children to drink milk when it will make them uncomfortable for much of the school day, and it is a waste of money. While milk is a highly nutritious

food for most children, those with lactose intolerance will require alternative foods to serve their nutritional needs.

Lead Poisoning

Certain minerals in the diet, such as lead, may have detrimental effects on the nervous system. Chronic lead poisoning in children has been shown to produce brain damage and thus affect intellectual development. At lower levels of toxicity, hyperactivity is associated with lead poisoning.

A study conducted at the Children's Hospital Medical Center in Boston investigated whether low lead level accumulation could have an influence on the school performance of 158 children. The determination of lead levels was made by measurements on their baby teeth. Evaluation of the children's school performance was made using conventional intelligence tests and evaluations by teachers. It was found that about 37% of this group had high lead levels in their baby teeth. The high lead group did not show any signs of acute or chronic lead poisoning, but they did show poorer school performance in their ability to process auditory inputs and in their verbal activity.

Lead can enter the body through air pollution, lead paints in older buildings, and foods. Ceramic glazes on dishes are another source of lead. Lead is in a wide variety of foods including breads, vegetables, organ meats, and milk. Large amounts have been detected in various baby foods, such as juices and evaporated milk. A zinc deficiency in the diet can result in a greater uptake of lead. Low levels of calcium and phosphorous can also raise lead absorption and retention. While lead poisoning is a serious problem, it is possible small amounts of lead may be nutritionally essential.

Nutrition and the Schools

Poor nutrition is frequently associated with other negative environmental factors in the home over which the school has limited control. Nevertheless, the school is involved with nutrition in several important ways, particularly in the school lunch program.

School Lunch Program

The federal school lunch program, created in 1947, is designed to give children a nutritionally adequate hot lunch and teach children good food habits. The school must operate the program without profit. It must provide a menu designated as a Type A lunch as established by the U.S. Department of Agriculture (U.S.D.A.). Low-income children receive lunch at lowered prices or without charge. This Type A lunch specifies what foods can be served and how much of each may be provided. It was designed by nutritionists to provide slightly less than 30% of the RDA for the young school child with proportionate increases as the children get older. Generally, in terms of what is provided, the menu does accomplish what it set out to do, assuming that all of the food is consumed in the designated amounts.

One of the major problems with the Type A lunch program is waste. This program works only if the designated quantities are consumed. Many nutritionists believe that there is considerable waste in the typical school cafeteria. The U.S.D.A. has been conducting a comprehensive study of this problem and should present its findings shortly. Perhaps, to avoid waste in the future, we should devise a scheme to group students in their eating habits just as we now do in other areas of the curriculum. Such a scheme might save money and also take recognition of individual differences in the nutritional needs of children.

There are two minor nutritional problems with the Type A lunch. One is that the levels of magnesium and vitamin B-6 may be too low. The other is that inadequate attention has been given to the different requirements of the two sexes in regard to several nutrients, including iron and calcium.

School Breakfast Program

A related program, the school breakfast program, supplies a standardized breakfast to certain school districts serving large numbers of deprived children. A former Washington, D.C. councilman commented to me that he felt that the serving of a good breakfast to those poor and frequently hungry students was the best thing that the school system did. Such a comment by a politician suggests that this function of the school is taken seriously, is appreciated, and is taking care of a need.

Is breakfast really important? The Iowa Breakfast Study is still viewed as one of the earliest and most important studies in this area. The study population was a small group of 12- to 14-year-old boys. After a three-week planning and orientation period, an experimental regimen was set up, beginning with a four-week basic cereal and milk breakfast period and continuing with alternating two 2-week periods of no breakfast and two 2-week periods of the basic cereal and milk breakfast. During all periods the total daily nutrient intake remained constant. During the planning period and the two experimental periods, data was gathered on each of the following: neuromuscular tremor magnitude, choice reaction time, maximum grip strength, grip strength endurance, maximum work rate, and maximum work output. The experiment found that maximum output and maximum work rate were significantly less in the late morning hours for the experimental periods of breakfast omission. Additional data provided by the teacher in charge of the group, who had made careful observations and records, found that most of the boys had a better attitude and achieved better during the basic breakfast period than they did during the no breakfast period.

An early British study found that a milk break was associated with improved classroom performance and examination scores. At the same

time, a second study found that mid-morning milk relieved hunger pangs and nervousness in about half the children, while even more showed better concentration, persistence, calmness, and sociability with milk plus food concentrate. A Swedish study revealed that breakfast intakes of less than 400 kcal. had an adverse effect on performance. A study of nursery school children found that a fruit juice snack at mid-morning helped to relieve fatigue, lower irritability, and promote positive behavior. One study of low-income first-graders in New England found that a 300 kcal. milk-based snack in the morning or in the afternoon improved scores in three tests of selective attention, while eating breakfast alone had no impact.

Other studies have found no effects resulting from breakfast consumption. Critics have also argued that some studies could not really establish whether the behavioral changes were due to nutritional improvement or to the Hawthorne effect. It is also worth noting that in many cultures, breakfast is not part of the established daily pattern and here the detrimental effects of omitting breakfast would probably be nil. If a student has never had breakfast as a part of his daily routine or has it only occasionally, it is probable that he will not be affected one way or the other.

Some of the studies in this area argue against a very long period between starting classes until lunch without some snack. Overall, while admitting the need for further research and that some students are probably not influenced by feeding programs, there remain strong indications that feeding programs decrease student apathy and can improve attitude, behavior and school performance. Schools should support reasonable feeding programs, be conscious of different student eating patterns, and emphasize that breakfast is generally still a good idea.

Nutrition Education

Providing a nutritious lunch or breakfast in the schools is no guarantee that children will learn and practice good nutrition habits. If children are to acquire the essential knowledge and attitudes of good nutrition, then the schools must provide ongoing nutrition education programs.

Nationally there seems to be no consistent pattern of nutrition education in our schools. Some attention is given to the subject in health classes. Probably the most systematic treatment of the subject is in home economics classes, but these classes are taken by only a small percentage of students in secondary schools. Also there has been little evaluation and few good follow-up studies of the overall effectiveness of nutrition education.

A school system committed to comprehensive nutrition education needs a developmental curriculum that will provide sequential concepts in nutrition for students at various age levels. In addition to a developmental nutrition curriculum, there are many incidental opportunities to integrate nutrition concepts and attitudes into other areas of the curriculum, such as biology, consumer economics, and social studies. The school lunch program itself can be made into a nutrition learning experience.

Resources for nutrition education are readily available. In addition to the basic nutrition textbooks listed in the bibliography of this fastback, there are good materials available from food associations such as the National Dairy Council. Not to be overlooked as a resource is the food section of the daily newspaper.

Basic to good nutrition education are teachers who are informed about the topic. Are teachers prepared to undertake this assignment? One study of the nutrition knowledge and attitudes of 910 Nebraska teachers in kindergarten through third grade does not offer much encouragement. Less than 10% had taken a college-level nutrition course, although most had been exposed to some nutrition knowledge in other courses. They scored on the average only 58.3 out of a possible 140 points on a test of nutrition knowledge. Most were unable to specify the composition of a good breakfast or to indicate how they might influence attitudes about nutrition. These findings as well as others suggest that elementary teachers will need better preparation and in-service education if they are to assume a major role in nutrition education.

School Nutritional Environment

The nutritional environment of a school is reflected in its food

policies and practices beyond the lunch or breakfast program. Whether to allow soft drink and candy vending machines in the school is a policy decision with nutritional implications. A decision to prohibit such vending machines may not prevent students from drinking and eating these highly caloric foods of dubious nutritional value, but it is a direct way for the school to make a statement about positive nutritional practices.

School fund-raising projects involving the sale of candy is another activity that could be questioned on nutritional grounds. Prohibiting candy sales may not be a popular decision with students or with the candy companies that depend on this marketing strategy for their livelihood, but such a decision says to students and the community that the school board and the administration attach great importance to the total nutritional environment of the school.

Summary

This fastback has pointed out how nutritional deficiencies and imbalances can influence learning directly or indirectly. While these influences may be quite subtle at times, educators who are informed about the relationship of nutrition to learning will be more aware of behavioral symptoms that could indicate nutritional problems in students. By making careful observations and by asking the right questions about diet, educators can assist parents and medical personnel in diagnosing nutritional problems that are affecting students' performance in the classroom.

Our schools are currently involved in meeting children's nutritional needs directly through school lunch programs, but they also have a preventive role to play through nutrition education programs and by creating a positive nutritional atmosphere throughout the school.

Heredity may well be the architect of human development, but nutrition provides the building blocks for the growth of healthy alert children. Educators can add to those building blocks by becoming informed about nutrition and about its influence on learning.

Bibliography

Arlin, Marian. *The Science of Nutrition*. New York: Macmillan, 1977.

Bernarde, Melvin. *The Chemicals We Eat*. New York: McGraw Hill, 1971.

Briggs, George M., and Calloway, Doris H. *Nutrition and Physical Fitness*. Philadelphia: W. B. Saunders Company, 1979.

Coman, C. L., and Bonner, F. *Mineral Metabolism*. New York: Academic Press, 1969.

Food and Nutrition Board, National Research Council. *Recommended Dietary Allowances*. Washington, D.C.: National Academy of Sciences, 1974.

Fredericks, Carlton. *Psychonutrition*. New York: Grosset and Dunlap, 1976.

Guthrie, Helen Andrews. *Nutrition*. St. Louis: C. V. Mosby Co., 1975.

Lamb, M., and Harden, M. *The Meaning of Human Nutrition*. New York: Pergamon Press, 1973.

Lloyd-Still, J. D. *Malnutrition and Intellectual Development*. Littleton, Mass.: Publishing Sciences Group, Inc., 1976.

Manocha, S. *Malnutrition and Retarded Human Development*. Springfield, Ill.: Charles C. Thomas, 1972.

Robinson, Corinne. *Fundamentals of Normal Nutrition*. New York: Macmillan, 1978.

Rodale, J. F. *The Complete Book of Minerals for Health*. Emmaus, Pa.: Rodale Books Inc., 1972.

Scrimshaw, N. S., and Gordon, J. E., eds. *Malnutrition, Learning and Behavior*. Cambridge: MIT Press, 1968.

Serban, George. *Nutrition and Mental Functions*. New York: Plenum Press, 1975.

Shneous, E. A. *The Malnourished Mind*. New York: Anchor Press, Doubleday and Co., 1974.

Underwood, Eric. *Trace Elements in Human and Animal Nutrition*. New York: Academic Press, 1977.

Winick, Myron. *Malnutrition and Brain Development*. New York: Oxford University Press, 1976.

PDK Fastback Series Titles

1. Schools Without Property Taxes: Hope or Illusion?
2. The Best Kept Secret of the Past 5,000 Years: Women Are Ready for Leadership in Education
3. Open Education: Promise and Problems
4. Performance Contracting: Who Profits Most?
*5. Too Many Teachers: Fact or Fiction?
6. How Schools Can Apply Systems Analysis
7. Busing: A Moral Issue
8. Discipline or Disaster?
9. Learning Systems for the Future
10. Who Should Go to College?
11. Alternative Schools in Action
12. What Do Students Really Want?
13. What Should the Schools Teach?
14. How to Achieve Accountability in the Public Schools
15. Needed: A New Kind of Teacher
16. Information Sources and Services in Education
17. Systematic Thinking about Education
18. Selecting Children's Reading
19. Sex Differences in Learning to Read
20. Is Creativity Teachable?
21. Teachers and Politics
22. The Middle School: Whence? What? Whither?
23. Publish: Don't Perish
24. Education for a New Society
25. The Crisis in Education Is Outside the Classroom
26. The Teacher and the Drug Scene
*27. The Liveliest Seminar in Town
28. Education for a Global Society
29. Can Intelligence Be Taught?
30. How to Recognize a Good School
31. In Between: The Adolescent's Struggle for Independence
32. Effective Teaching in the Desegregated School
33. The Art of Followership (What Happened to the Indians?)
34. Leaders Live with Crises
35. Marshalling Community Leadership to Support the Public Schools
36. Preparing Educational Leaders: New Challenges and New Perspectives
37. General Education: The Search for a Rationale
38. The Humane Leader
39. Parliamentary Procedure: Tool of Leadership
40. Aphorisms on Education
41. Metrication: American Style
42. Optional Alternative Public Schools
43. Motivation and Learning in School
44. Informal Learning
45. Learning Without a Teacher
46. Violence in the Schools: Causes and Remedies
47. The School's Responsibility for Sex Education
48. Three Views of Competency-Based Teacher Education: I Theory
49. Three Views of Competency-Based Teacher Education: II University of Houston
50. Three Views of Competency-Based Teacher Education: III University of Nebraska
51. A University for the World: The United Nations Plan
52. Oikos, the Environment and Education
53. Transpersonal Psychology in Education
54. Simulation Games for the Classroom
55. School Volunteers: Who Needs Them?
56. Equity in School Financing: Full State Funding
57. Equity in School Financing: District Power Equalizing
58. The Computer in the School
59. The Legal Rights of Students
60. The Word Game: Improving Communications
61. Planning the Rest of Your Life
62. The People and Their Schools: Community Participation
63. The Battle of the Books: Kanawha County
64. The Community as Textbook
65. Students Teach Students
66. The Pros and Cons of Ability Grouping
67. A Conservative Alternative School: The A+ School in Cupertino
68. How Much Are Our Young People Learning? The Story of the National Assessment
69. Diversity in Higher Education: Reform in the Colleges
70. Dramatics in the Classroom: Making Lessons Come Alive
71. Teacher Centers and Inservice Education
72. Alternatives to Growth: Education for a Stable Society
73. Thomas Jefferson and the Education of a New Nation
74. Three Early Champions of Education: Benjamin Franklin, Benjamin Rush, and Noah Webster
75. A History of Compulsory Education Laws
76. The American Teacher: 1776-1976
77. The Urban School Superintendency: A Century and a Half of Change
78. Private Schools: From the Puritans to the Present
79. The People and Their Schools
80. Schools of the Past: A Treasury of Photographs
81. Sexism: New Issue in American Education
82. Computers in the Curriculum
83. The Legal Rights of Teachers
84. Learning in Two Languages
84S. Learning in Two Languages (Spanish edition)
85. Getting It All Together: Confluent Education
86. Silent Language in the Classroom
87. Multiethnic Education: Practices and Promises
88. How a School Board Operates
89. What Can We Learn from the Schools of China?
90. Education in South Africa
91. What I've Learned About Values Education
92. The Abuses of Standardized Testing
93. The Uses of Standardized Testing
94. What the People Think About Their Schools: Gallup's Findings
95. Defining the Basics of American Education

(Continued on inside back cover)

*Out of print

33

See inside back cover for prices.

Fastback Titles *(Continued from back cover)*

96. Some Practical Laws of Learning
97. Reading 1967-1977: A Decade of Change and Promise
98. The Future of Teacher Power in America
99. Collective Bargaining in the Public Schools
100. How to Individualize Learning
101. Winchester: A Community School for the Urbanvantaged
102. Affective Education in Philadelphia
103. Teaching with Film
104. Career Education: An Open Door Policy
105. The Good Mind
106. Law in the Curriculum
107. Fostering a Pluralistic Society Through Multi-Ethnic Education
108. Education and the Brain
109. Bonding: The First Basic in Education
110. Selecting Instructional Materials
111. Teacher Improvement Through Clinical Supervision
112. Places and Spaces: Environmental Psychology in Education
113. Artists as Teachers
114. Using Role Playing in the Classroom
115. Management by Objectives in the Schools
116. Declining Enrollments: A New Dilemma for Educators
117. Teacher Centers—Where, What, Why?
118. The Case for Competency-Based Education
119. Teaching the Gifted and Talented
120. Parents Have Rights, Too!
121. Student Discipline and the Law
122. British Schools and Ours
123. Church-State Issues in Education
124. Mainstreaming: Merging Regular and Special Education
125. Early Field Experiences in Teacher Education
126. Student and Teacher Absenteeism
127. Writing Centers in the Elementary School
128. A Primer on Piaget
129. The Restoration of Standards: The Modesto Plan
130. Dealing with Stress: A Challenge for Educators
131. Futuristics and Education
132. How Parent-Teacher Conferences Build Partnerships
133. Early Childhood Education: Foundations for Lifelong Learning
134. Teaching about the Creation/Evolution Controversy
135. Performance Evaluation of Educational Personnel
136. Writing for Education Journals
137. Minimum Competency Testing
138. Legal Implications of Minimum Competency Testing
139. Energy Education: Goals and Practices
140. Education in West Germany: A Quest for Excellence
141. Magnet Schools: An Approach to Voluntary Desegregation
142. Intercultural Education
143. The Process of Grant Proposal Development
144. Citizenship and Consumer Education: Key Assumptions and Basic Competencies
145. Migrant Education: Teaching the Wandering Ones
146. Controversial Issues in Our Schools
147. Nutrition and Learning
148. Education in the USSR
149. Teaching with Newspapers: The Living Curriculum
150. Population, Education, and Children's Futures
151. Bibliotherapy: The Right Book at the Right Time
152. Educational Planning for Educational Success

This fastback and others in the series are made available at low cost through the Phi Delta Kappa Educational Foundation, established in 1966 with a bequest from George H. Reavis. The foundation exists to promote a better understanding of the nature of the educative process and the relation of education to human welfare.

Single copies of fastbacks are 75¢ (60¢ to Phi Delta Kappa members).

Quantity discounts for any title or combination of titles are:

Number of Copies	Nonmember Price	Member Price
10— 24	48¢/copy	45¢/copy
25— 99	45¢/copy	42¢/copy
100—499	42¢/copy	39¢/copy
500—999	39¢/copy	36¢/copy
1,000 or more	36¢/copy	33¢/copy

Prices are subject to change without notice.

A $1 handling fee will be charged on orders under $5 if payment is not enclosed. Indiana residents add 4% sales tax.

Order from PHI DELTA KAPPA, Eighth and Union, Box 789, Bloomington, IN 47402.